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Review Article

The Interactions of Nutrition and Sleep Quality Focus on Melatonin Synthesis: A literature Review

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Abstract

Aim: Nutrition plays a role as a provider of energy for the human body which is important for the formation and maintenance, especially to improve the quality of sleep seen from the production of the hormone melatonin. The purpose of this study was to determine the interaction of nutrition on sleep quality: the focus synthesis of melatonin.
Design: We performed a literature review study by reviewing 6 international journals related to the interaction of nutrition and sleep quality: focused on melatonin synthesis.
Methods: Data collection was done by searching for data-based articles or journals published through the Willey Online Library, PMC, Proquest, and Pubmed. The data were analyzed by descriptive analysis and the journals were assessed using JBI.
Results: The interaction of nutrition and sleep quality is seen from the hormone melatonin, based on the results of 6 journals. The results were described that the relationship between macronutrient and micronutrient nutrition on melatonin production that affects human sleep quality.
Conclusions: Macronutrients and micronutrients are related to sleep quality in increasing the production of the hormone melatonin.

Keywords
Nutrition, Macronutrients, Micronutrients, Sleep quality, Melatonin

INTRODUCTION

According to the prevalence by WHO, the problem of malnutrition in adults is around 800 million in the world (1). According to Basic Health Research (Riskesdas), nutritional deficiencies in adolescents occur with a prevalence of 25.7% and 26.9% in adults (2) . The need for the proportion of macronutrients and micronutrients needed by the body according to general guidelines for balanced nutrition (PUGS) is 50% for carbohydrates, 25% for fat, 15% for protein and the remaining 10% for minerals and vitamins (3).

Sleep disturbances in adults are reported annually to increase by 20% to 50% with 17% of them experiencing serious sleep disorders (4) (5) . Sleep is a worldwide health problem with an

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average prevalence rate between 10% to 30% (6). Research according De Ridder (7) reported that 30% to 48% of insomnia occurred in adults and 23.8% of insomnia occurred in adolescents. According to research by Lindsth (8), there are about 72% of adults experience the recommended sleep deprivation of 8 hours of sleep per day, and another 20% of adults sleep less than 6 hours per day.

Nutrition has a connection with sleep that affects each other. Excessive intake of nutrients can cause disorders of the endocrine system, gastrointestinal and circadian rhythm function (9). Sleep has an important role in human health and wellbeing. Insufficient sleep can be caused by lack of nutritional intake, causing ongoing sleep disturbances. Sleep disorders can cause a decrease in cognitive work that has an impact on daily activities, work and wellbeing (6). Nurses continue to provide care to individuals who experience physical health problems, including sleep disturbances, caused by many factors. The combination of nutrition regulation and physical activity can be a new knowledge in health promotion to individuals and families.

The hormone melatonin is closely related to sleep. The hormone melatonin in the body is produced in the pineal gland at night which is regulated by a dark light cycle controlled nucleus. The hormone melatonin will increase its production at one o'clock in the morning and four o'clock in the afternoon, then melatonin will be released and send a message to the circadian rhythm to go to sleep. Lack of melatonin production will result in poor sleep quality (10).

Based on the explanation above, the researchers wanted to know that macronutrient and micronutrient can affect sleep quality in terms in focus of melatonin synthesis because melatonin is a sleep regulation hormone in the body. Thus, the researchers are encouraged to do research using the title "Nutrition Interaction and Sleep Quality: Focus of Melatonin Synthesis".

METHODS

Study Design and PRISMA Diagram

A literatur review method was used to examine previously published articles on the topic of the interaction between nutrition and sleep quality: focused on melatonin synthesis.

Searching Strategies

The first step is to determine the database that will be used to enter the topic. Researchers used several databases, including Willey Online Library, PMC, Proquest and Pubmed. After entering the topic in the second database, several journals were found i.e., PubMed (n= 30), PMC (n= 1488), Online Wiley Library (n= 396) and ProQuest (n= 857). Then do the filtering of journals which is done by limiting the year and date of publication of the journal. Researchers conducted the last 5 years with search details starting from August 16, 2017 to August 16, 2021. Researchers obtained journals on the PubMed (n= 30), PMC (n= 1,488), Online Wiley Library (n= 396) and ProQuest (n= 857) of the year inspection process.

Researchers continue the research by looking for journals to open access and looking for journals by reading abstracts or titles that match the topic of research keywords in their respective databases. The researcher entered the

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journals that had been found into a folder according to the source database and got the results on PubMed (n= 6), PMC (n= 4), Online Wiley Library (n= 2) and ProQuest (n= 4), then the researcher removed duplication journals in the four database folders by combining all files from the four folders into 1 folder and checking for duplication in the citation manager application automatically one of the same files will be deleted, after filtering the deletion of duplicate journals, the results are (n=9) . Further researchers determined the full-text journal and the results obtained (n=6).

Inclusion Criteria, Exclusion Criteria, and Quality Appraisal

The journals that used have been determined based on inclusion and exclusion criteria. The inclusion criteria used include the suitability of the topic, the research method used is Randomized Control Trial, Cross Sectional Study, Correlation, Quasi Experimental and Longitudinal Study. while the exclusion criteria used Research methods: systematic review, meta-analysis, case studies. The final stage of the discovery of 6 journals is the process of analyzing with PICO (Problem, Intervention, Compare, Outcome) methode and JBI which will then calculate the JBI assessment score.

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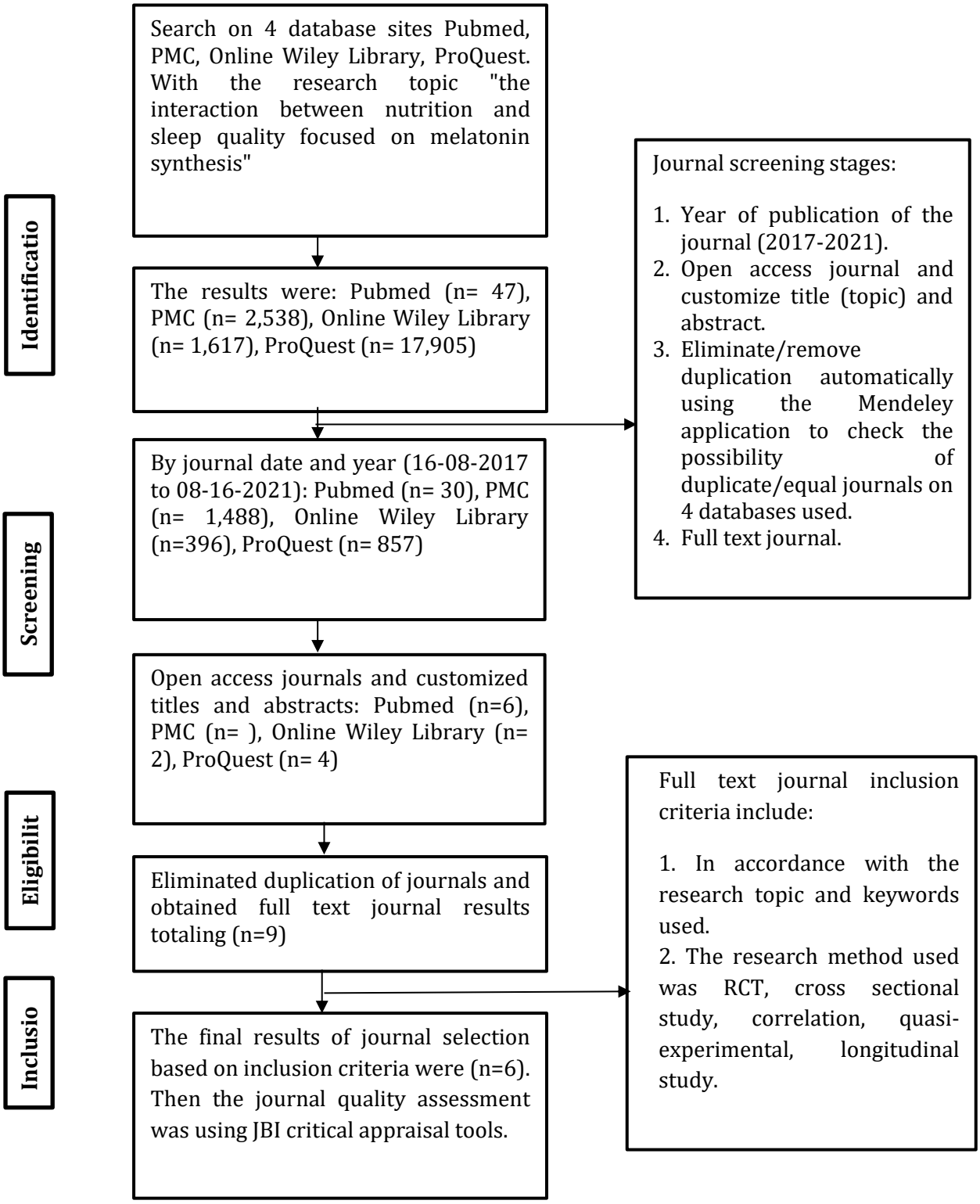

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RESULTS

The table 1 below showed the extraction data from six articles.

Table 1. Data Extraction

Author, Year, Country	Design	Study Setting	Intervention	Compare	Findings	Limitation
Hudson et al., (2020) (11) USA	RCT	Participants recruited from the Lafayette community, United States.	Protein intervention group. Participants consumed animal-based protein foods (meat, eggs, poultry, and seafood).	Control group giving non-protein. The food given is reduced from the amount of protein and given non-protein food.	Researchers get the results of measured melatonin concentration with immunoassay by analytical laboratory increased to 4 pg/mL.	Lack of active response from participants in the intervention group.
Wu et al., (2019) (12) Beijing, China	Cross sectional study	Participants from eight cities located in China.	(1) The recommended nutritional intake is given treatment. (2) Determining the composition Food. (3) Provide nutrition education in improving sleep quality. (4) Conducting a 24-hour recall to monitor	N/A	The researcher got the results from the Logistics Regression Analysis showing that better quality of food, like consumption of fish fruits eggs significantly improve poor sleep quality by looking at adjustments for gender, age, health condition, mental health, and BMI.	The study did not have a comparison on the sample.

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			overall eating patterns at the level of population			
Yang et al., (2020) (13) Taipei, Taiwan	RCT	Participants selected women with postmenopausal obesity.	The intervention group: (1) Consumption of 250g of tomato beef steak 2 hours before going to bed every day. (2) given nutrition education and nutrition consultation (based on diet records they keep).	The control group was only given the usual food.	Researchers got the results of the melatonin content of tomatoes 5.098 ± 1.817/ng. These results indicate that tomatoes have a high melatonin content and can improve sleep quality.	N/A
Panurywanti et al., (2021) (14) Indonesia	Experimetal study	The elderly were recruited from the Elderly Posyandu in Koncara, Purwakarta.	There are 2 intervention groups, namely: treatment group I (PI) who were given nutrition education and 130 grams ripe banana per day and treatment group II (PII) were given nutrition education and ripe 260 grams banana per day.	Control group was only given nutrition education.	Researchers got the results with decrease in sleep disturbance scores occurred in the administration of 130 grams of banana (PI) and 260 grams of banana (PII) with an average decrease in scores of 2.43 in PI and 2.50 in PII. Decreased sleep disturbance scores in this study, due to a synergistic effect on the content of banana which have high levels of melatonin, tryptophan that can improve	The researcher did not measure the levels of melatonin in the blood or urine, so it cannot be more objectively determine the increase in the levels of melatonin inside the blood or urine because of banana

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			Banana are given twice a day at 10:00 am and 15:00 pm.		metabolic processes and reduce symptoms of sleep disorders.	supplementation.
Tavakoli et al., (2021) (15) Iran	Cross Sectioal Study	Participants were recruited from a medical center in Tehran, Iran.	The intervention group was divided into high-carbohydrate and low-carbohydrate diets. Each group was assessed through the PSQI and FFQ questionnaires for sleep quality and nutritional intake.	The difference between the two groups is in the intake of carbohydrates. Where each group was given a little diet and high carbohydrate diet.	Researchers found that the intervention group given a low-carbohydrate diet had better sleep quality than the group given the high-carbohydrate intervention, which showed a difference in p-value. The P-value of the high-carbohydrate intervention group was 0.16 and the low-carbohydrate group was 0.3.	The sample taken is not large enough.
Bazyar et al., (2020) (16) Iran	Cross Sectioal Study	Participants in this study were drawn from Ahvaz Jundishapur University of Medical Sciences (AJUMS) in Iran.	Prior to the intervention, all students were given an assessment of diet. After that they were grouped based on the results of the diet questionnaire and recalled by the researchers by reviewing daily nutritional intake and sleep.	The difference in treatment was shown during recall, participants who had poorer sleep quality were studied in more detail about the nutritional intake they consumed.	Researchers found that students with mixed diet adherence were associated with better sleep quality than non-adherent students. This is indicated by the data where the intervention group has a value of 0.27; 95% and control group 0.13, 0.54%.	N/A

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DISCUSSION

From the analysis above, six articles were found that there was a correlation between nutrition, sleep, and melatonin production. Four out of six articles were mentioned that there was a correlation between nutrition and sleep quality. Additionally, two out of six articles were found that nutrition had a correlation with melatonin. Research to Hudson (11) found that adequate intake of macronutrient nutrients can provide better sleep changes. According to Panurywanti (14) wake and sleep cycles are influenced by the serotonergic system. Changes in the serotonergic system caused by insomnia or inflammation change sleep patterns and result in the REM (Rapid Eye Movement).

Circadian rhythm is a biological process that regulates sleep and wake cycles and endogenous oscillations. The circadian rhythm of the human body is modulated by environmental light sources. Catching external light, the retina sends neuronal messages to the central clock, the suprachiasmatic nucleus (SCN), detects the timing of the light/dark cycle. Then, the SCN relays a signal to the pineal gland to secrete melatonin. Melatonin is a peripheral clock zeitgeber, and can bind to melatonin receptors and modulate the sleep/wake cycle (13).

Sleep disturbances are usually caused by a lack of unbalanced nutritional intake. Nutrient intake that is not optimal can have an impact on poor sleep quality and cause disease. This problem often occurs in women, due to improper dietary patterns (15). Regulation of nutrition according to the Mediterranean diet can reduce the level of sleep disturbances. The Mediterranean diet is a healthy diet in which there are macronutrients and micronutrients. The nutrients consumed are rich in carbohydrates, proteins, fats, vitamins and minerals. If the Mediterranean diet is done every day it can, provide a good duration of sleep (16).

The best nutritional intake to improve sleep and excessive consumption is protein intake. Protein intake itself affects sleep because the amino acids tryptophan and tyrosine are precursors to the sleep-related neurotransmitters melatonin and dopamine. Consumption of protein alone is still insufficient if it is not balanced with other nutrients such as carbohydrates, fats, minerals and vitamins. One of the foods that contain macronutrients and micronutrients is tomatoes. Tomatoes contain vitamin C in them which can help the production of melatonin (11). Based on these results nurses can provide information and increase knowledge for individuals who have sleep disorders by consuming foods high in protein and tomatoes.

CONCLUSION

This literature review adhered to PRISMA guidelines to reduce bias in literature selection, as well as JBI to assess the strength and validity of the literature. However, the database search did not include unpublished literature, which may have resulted in an incomplete summary of the evidence on this topic.

Important nutrients are closely related to the quality of human sleep. Lack of macronutrients and micronutrients has an impact on decreasing melatonin production which causes sleep disturbances. The effects of

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macronutrients and micronutrients consumed as expected will have an impact on sleep quality by influencing the duration of REM and NREM sleep stages. Our research found that there was a relationship between nutrition and sleep quality in terms of the focus of melatonin synthesis. Based on the results of this study, nurses are expected to be able to understand the relationship between nutrition and sleep quality, and can provide education on the importance of adequate nutritional intake on sleep quality in the community.

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